Park-wide Perceived or Potential Threats to Natural Resources at New River Gorge National River

Aside from the threats to individual natural resources described earlier in this report, several other activities that occur in or around the park have the potential to affect a wide variety of natural resources. These activities—non-point source water pollution, oil and gas operations, mining (including mountaintop mining), parkway construction, and recreation—could affect both aquatic and terrestrial ecosystems and processes at NERI.

Non-point Source Water Pollution

Non-point source water pollution is generated by development, roads, logging, mining, agriculture, and other land uses. Major pollutants derived from non-point sources are sedimentation, nutrient inputs (including sewage), and contaminants contained in stormwater runoff.

Non-point source water pollution from agriculture may be transported to NERI from the Greenbrier River, Bluestone River, and other upper subbasins that are experiencing increased agricultural activity (Mott 1995). Nutrient inputs from the Bluestone River basins contribute to eutrophication in Bluestone Lake (Mott 1995). Subsequent releases of phytoplankton in the dam's tailwaters provide food for larval black flies in upper NERI (Voshell 1984). Additionally, agricultural runoff can be a source of other contaminants such as herbicides applied to corn and other row crops raised in the upper basins of the New River watershed (D. Chambers, 2004, USGS, pers. comm.).

Almost one-third of the land within NERI boundaries remains in private ownership. NPS authority on these lands is limited and uncontrolled human growth could increase non-point pollution loads in the river and tributaries primarily due to increased pressure on inadequate sewage treatment plants. Land-use planning is virtually nonexistent in this portion of West Virginia, and land-use studies have not been conducted for the areas surrounding NERI.

Overall human population increased in West Virginia from 1990-2000 and the general trend is for larger population centers in this portion of West Virginia to continue to grow (Mott 1995; U.S. Census Bureau). In most municipalities stormwater and sewage are routed through the same systems (Mott 1995). Urban runoff can be a source of heavy metals and other contaminants and may be contributing to pollution in streams.

Non-point source pollution from highways also threatens water quality at NERI. Toxic spills of chemicals along highways and railroads within the park are potential threats to streams (Purvis et al. 2002). A major rail line runs the length of NERI leading from Charleston to markets south and east (Mott 1995). Two major highways and four smaller roads also cross NERI, and the approaches to the river are typically steep. Hazardous material spilled by a derailment or tanker-truck accident would likely reach the New River. Approximately four derailments have occurred in the past 10 years, usually spilling coal, but one accident involved sulfated mercury (Mott 1995). In an effort to prepare for potential chemical spills at NERI, the NPS has cooperated with

the USGS to conduct time-of-travel studies simulating the movement and dispersion of soluble and insoluble contaminants in the New River (Appel and Moles 1987). Models were then employed to determine how and when releases from upstream impoundments could be used to dilute a spilled chemical or speed its passage through sensitive park waters (Wiley 1992).

Oil and Gas Operations

The USGS estimated undiscovered potential combined oil and gas resources of 1,104,357,021.7 m^3 (39 billion ft^3) beneath NERI (Geologic Resources Division 2003). Land acquisition for the formation of the park did not include mineral rights and much of the land within the authorized boundary remains in private ownership. No law or legislation ensures that these natural gas and oil deposits will not or cannot be extracted in the park (Mott 1995).

Increased natural gas and oil extraction activity, such as new drilling, reworking old wells, and laying new gas lines, does have the potential to damage park resources (O'Dell and Norby 2002). Potential impacts resulting from new gas or oil well drilling include: decline in surface water quality due to erosion from access roads, drill sites, and pipeline corridors; contamination of surface and groundwaters by drilling muds, fuels, brine, wastes, and other pollutants; deep zone salt water infusion into shallow freshwater zones due to inadequately constructed, maintained, or plugged wells; increased soil erosion and soil instability due to clearing, grading, and cut-and-fill activities associated with roads, pipelines, and drilling site preparation; nonnative plant introductions due to altered topsoil and other disturbances; decline in air quality due to dust from construction, traffic, exhaust fumes, and natural gas flaring; increased habitat fragmentation due to road building; disruption of wildlife and fish due to human activities and habitat alteration; intrusion on viewsheds and night sky viewing due to roads, well pads, traffic, rig and production site lighting, and gas flares; damage to archeological, cultural, and geologic resources due to blasting for road or pad construction; and increased noise due to seismic exploration, construction, drilling, and production operations (O'Dell and Norby 2002). Vegetation and soils appear to be most impacted by gas and oil wells that are constructed on well pads in hilly, forested terrain (O'Dell and Norby 2002). Based on current gas wells in the area, disturbances associated with well pads vary in size from wide spots in the road up to about 0.8 ha (2 acres) (O'Dell and Norby 2002).

In order to minimize the potential detriments to natural resources, NPS regulations governing nonfederal oil and gas rights should be followed (36 CFR 9B). In many places in NERI, gas gathering lines associated with wells are not buried and vegetation does not seem to be actively managed along the lines, indicating that NPS regulations may not be being followed (O'Dell and Norby 2002). Difficulty in enforcement of regulations and a lack of park boundary markers in many locations make it impractical for the oil and gas operators to know when exactly they are entering the park (O'Dell and Norby 2002). It is essential to determine ownership status of current wells, determine the routes of gas lines, determine the parties responsible for their maintenance and operations, establish a schedule and protocol for monitoring oil and gas operations, gate leased roads, and plug inactive gas wells, and clearly mark park boundaries (O'Dell and Norby 2002).

Mining

As much as 7.1 million tons of surface recoverable coal are contained within the boundary of NERI (NPS 1982). Land acquisition for the formation of the park did not include mineral rights and much of the land within the boundary remains in private ownership. No law or legislation guarantees these deposits will not or cannot be mined where they remain in private ownership (Mott 1995). However, severe restrictions have been placed on coal mining in NERI's enabling legislation and by the 1977 Surface Mining Coal and Reclamation Act (SMCRA) which designates units of the NPS unsuitable for surface coal mining (Mott 1995). The implementation of the SMCRA generally resulted in improved water quality in streams in the New River-Kanawha basin between 1980 and 1998 (Paybins et al. 2000). However, there were still discernible effects of coal mining on streams in this basin. For example, streams draining basins that have been mined since 1980 show increased dissolved sulfate, decreased median bed-sediment particle size, and impaired benthic-invertebrate communities compared to streams not mined since 1980 (Paybins et al. 2000). In addition, nickel, chromium, and zinc were found in bed sediments in concentrations that could harm aquatic life (Paybins et al. 2000). Furthermore, elevated sulfate concentration and slightly acidic water were more common at wells within 1,000 feet of reclaimed mines than elsewhere (Paybins et al. 2000). Finally, coal mining also has changed the composition of gravel bars in the New River as coal particulates are introduced to the sediment load and deposited in the bars (D. Chambers, 2003, USGS, pers. comm.).

Increased mechanization of coal mining in West Virginia has led to extensive use of mountaintop removal mining to reach coal seams (Wiley and Brogan 2003). Excess overburden from mountaintop removal is placed in adjacent headwater valleys, creating "valley fills." Mountaintop mining and valley filling have replaced forested landscapes containing layered sedimentary rocks with grass-covered landscapes underlain by poorly sorted rock fragments (Wiley and Brogan 2003). Although there are no valley fill locations in or immediately adjacent to NERI (Messinger 2003), as mining expands, this approach potentially could affect NERI. In West Virginia, mountaintop mining seems to have an effect on peak discharges in streams. In particular, valley fill practices seem to cause increased variability in flood events (Wiley and Brogan 2003), probably due to changes in surface slopes and permeability, deforestation, and other reclamation practices. Messinger (2003) found that large-scale surface coal mining and associated valley fill changed the response of streams to storm events. During storm events when rainfall intensity exceeded 2.5 cm (1 in) per hour, runoff from streams in a valley-filled watershed exceeded peak runoff from an unmined watershed (Messinger 2003). This difference was potentially due to loss of canopy cover in the filled valley, which helps to intercept and retain rainfall (Messinger 2003).

New River Parkway, I-64 to Hinton

In an effort to provide visitor access to the southern portion of NERI, the New River Parkway has been proposed by West Virginia Department of Transportation (WV DOT) with the preferred alternative following the western portion of the New River from I-64 with one river crossing near Sandstone Falls (USDOT, WVDOT 1998). The construction of this road would expand the footprint of the existing Route 26 that follows a similar route along the western side of this portion of the New River. The construction process and completed project will disrupt

the visual resources of hillslopes and affect the highly important viewshed across the New River upstream of Sandstone Falls (USDOT, WVDOT 1998). In addition, severe erosion and sedimentation, and localized flooding could occur during construction if highly erodible, steep slopes are destabilized. This erosion may have negative effects on terrestrial and aquatic habitat (USDOT, WVDOT 1998). Furthermore, stormwater runoff from the completed road could negatively affect water resources and wetlands within NERI (USDOT, WVDOT 1998). Wetlands along the edge of New River will be adversely affected due to the placement of fill materials into wetlands at bridge pier footings locations associated with proposed river crossings (USDOT, WVDOT 1998). Impacts to terrestrial habitat will include disturbance and direct habitat destruction resulting from project construction. Impacts to aquatic habitats will encompass habitat destruction, potential disturbance of spawning beds, and filling or restricting of streams (USDOT, WVDOT 1998). Several species of state species of special concern could be negatively affected by construction. The elktoe mussel, a state species of special concern, and the Indiana bat, a federally listed endangered species, have the potential to be negatively affected by construction of this project. Several state species of special concern, a rare sedge (*Carex molesta*), black-bellied salamander, green salamander, and Atlantic three-toothed snail (*Triodeopsis juxtidens*), have the potential to be directly impacted by construction of this project. An example of the Appalachian flatrock and sandstone cliff communities present in the park could potentially be degraded or damaged as a result of increased human activities in and adjacent to the new parkway. In addition, development of parkway recreation facilities may have secondary negative impacts to natural resources at NERI (USDOT, WVDOT 1998).

Recreation

Recreation is a critical consideration in the assessment of natural resources at NERI (NPS and New River Gorge Citizen's Task Force 1987). Approximately 1,230,000 people visited NERI in 2000, with visitation peaking in July. In addition, 150,000 visitors take commercially operated white-water rafting trips through the New River Gorge. In 1987, the NPS and the New River Gorge Citizen's Task Force prepared a river management plan for NERI. The purpose of the plan was to provide the opportunity for high quality recreation experiences at NERI (NPS and New River Gorge Citizen's Task Force 1987). The plan prioritized management actions, land acquisition, and development concepts. Multiple approaches were recommended including increasing visitor use by improving scenic byways and restricting visitors to primitive campsites within federal lands (NPS and New River Gorge Citizen's Task Force 1987).

White-water Rafting

White-water rafting is the most significant recreational activity at NERI. Total average expenditures by rafters on the New River in 1995 were $29.4 million and represented a significant portion of the local economy. Rafters reported few natural resource impact problems at NERI, but those that they identified included litter and debris along the river, trampled vegetation, soil erosion, graffiti, bad odors, and sewage (Whisman et al. 1996).

White-water rafters negatively affect natural resources primarily at day-use and some overnight camping sites (Cole and Marion 1987; Leung and Marion 1998). In general, the day-use sites are free of litter; however, lunching clientele tend to spread themselves out across a day-use site so

that, over time, these sites increase in size. Sites that are used repetitively are devoid of understory vegetation and portions of the sites may be aesthetically unappealing due to latrine use (primarily urination). As sites become aesthetically unappealing, rafting guides may seek other sites for use, thus, leading to a proliferation of recreation sites along the river. In addition, the riverbanks at these day-use sites are often eroded due to the movement of people from their rafts to the site. Leung and Marion (1998) indicated that day-use and/or overnight sites that are accessible by road, as opposed to those that are accessible only by river, tended to have more negative natural resource impacts.

White-water rafting does not seem to negatively affect wildlife at NERI (Patterson et al. 1988). Wood ducks (*Aix sponsa*) were the only species identified as potentially being affected by recreational users along the New River (Patterson et al. 1988). Theoretically, breeding wood ducks in May and June may be disturbed by increased human activities near nesting locations along the New River. However, no study has been conducted that specifically identifies areas used by wood duck broods and/or evaluates the impacts of recreational use on this species.

Literature suggests several management recommendations to minimize the effects of white-water rafting day-use and overnight camping sites on natural resources. For example, at Delaware Water Gap National Recreation Area, recreation impacts have been minimized through site closure, concentrating use, and providing visitor information (Marion 1994). Where possible, day-use and overnight camping sites can be designed and constructed to spatially concentrate people; thus, allowing a site to support more people with fewer negative effects to natural resources. Marion and Farrell (2002) recommend site designs for campsites that could be adopted at day-use sites to minimize visitor impacts at NERI.

Rafters identified availability of bathroom facilities as the most serious facility problem on the New River (Whisman et al. 1996). In order to address this problem, latrines should be placed at day-use and overnight camping sites (above the high-water level) for use by rafters (Marion 1994). Since the majority of day-use and overnight camping sites at NERI are accessible by road (Leung and Marion 1998) these latrines could be pumped regularly.

Another way to minimize recreational impacts by white-water rafters is through educational efforts with the guides, such as the Leave No Trace program (Leung and Marion 1998). Leave No Trace implementations could include the use of portable toilets by guides and minimization of the area used at recreation sites. It is imperative, however, that resource managers at NERI work with the rafting community to best situate day-use and overnight sites in order to ensure their proper use by rafters.

To better protect natural resources from damage of white-water recreation impact, all day-use and overnight camping sites should be mapped and inventoried at NERI. A map of these sites could then be overlaid with a map that depicts vegetation communities and rare species occurrences at NERI. Rare and sensitive species and communities co-occurring with day-use and/or overnight camping sites should be protected from potentially negative effects of visitors. NERI personnel could close these sites and implement management recommendations to direct users to other, less sensitive sites.

Parking areas for rafting companies often are located on private lands but could have negative impacts on natural resources in NERI by causing soil erosion, gas/oil leachate, and car exhaust. In order to minimize these impacts, proper location and design of parking areas and access roads would limit or eliminate many of these problems (J. Marion, 2003, NPS, pers. comm.). In addition, a mapping effort showing the locations of parking areas and access roads would assist managers in directing improvement efforts. Once again, it is vital to work closely with the rafting community to ensure that improvements are incorporated even on private holdings.

Fishing

The stretch of river from Hinton to Sandstone Falls is one of the most popular fishing areas in West Virginia (Buhlmann 1990). Popular fishing sites at NERI are primarily located along the banks of the New River downstream of Thurmond. The total area disturbed, as exhibited by littering, de-vegetation, shoreline erosion, felled trees, soil, rock, and tree root exposure, soil compaction, and human waste was less at fishing sites than at rafting day-use and/or overnight camping sites (Cole and Marion 1987). The total land area disturbed at sites used by rafters was 50% greater than the area disturbed at sites used by anglers (Cole and Marion 1987). However, litter and tree damage were more common at fishing sites than at rafting sites (Cole and Marion 1987). Anecdotal reports indicate that fishermen often start campfires and burn downed trees and tires at fishing sites. The number of anglers using fishing sites is lower than the number of rafters that use day-use and/or overnight camping sites; however, no data are available that quantify fishermen use of NERI (Purvis et al. 2002).

Introduction and spread of nonnative species of fish and crayfish through the dumping of bait buckets by anglers is a pervasive problem in NERI (Purvis et al. 2002). In addition, nonnative species of trout are stocked by the WV DNR in tributaries to the New River (Purvis et al. 2002). Introducing nonnative species may disturb natural communities and is contrary to fundamental NPS management practices (Purvis et al. 2002). Streams stocked with nonnative rainbow and brown trout include Wolf Creek (temporarily not stocked due to poor water quality), both Glade Creeks, Pinch Creek, Dunloup Creek, and Meadow Creek. In NERI tributaries, most stocked trout do not survive the fishing pressure, poor water quality, and warm temperatures of summer, and are replaced each spring by the state (Purvis et al. 2002). Currently, the New River is not directly stocked with any fish, but stocked trout do migrate in from tributaries.

Trail and Road Use

Jensen et al. (1993) developed a trail plan for NERI that proposed equestrian, hiking, mountain bicycling, interpretation, and wheelchair access trails. The implementation of this plan lead to the development of a trail map that is available for the park (Jensen et al. 1993). The trail map lists 27 official trails for the park. The use of well-designed day-use hiking trails should not have an adverse effect on natural resources. However, horse trails potentially have a much more negative impact on natural resources than hiking trails. The major problems with horse trails are increased soil erosion, muddiness, and gradual trail widening (Marion, 2003, pers. comm.). Biking trails have the potential to have the same negative effects as equestrian trails. Careful placement and design of trails will limit the negative effects of biking and equestrian trails on natural resources. Jensen et al. (1993) proposed one wheelchair accessible trail at NERI.

Although not currently completed, once the trail is in place and paved it should not have additional negative effects on natural resources.

In addition to trails, there are miles of backcountry roads in NERI that are no longer maintained but still may be used by visitors for vehicular river access, hiking, and off-road vehicles. Improper use of these roads has the potential to contribute to soil erosion. In order to prevent or limit soil erosion public access to some backcountry roads should be limited. A survey of backcountry road users should be conducted to ascertain which roads are most frequently used and chosen routes should be properly designed and maintained.

Rock-climbing

Rock-climbing at NERI continues to grow in popularity as illustrated by the number of permits requested and issued to climbing businesses (Jarvis 2002). Large groups and increased use of commercial rock-climbing guide services have led to adverse natural resource impacts. These impacts include:

- Soil erosion and compaction both at the top and bottom of cliffs.
- Location of unauthorized trails to climbing areas that impact sensitive or critical habitat for plant or animal species.
- The potential for gymnastic chalk used by climbers to change the chemical balance of soils and impact flora and fauna.
- The potential for preventing peregrine falcons from nesting in NERI (Jarvis 2002).

The park banned the use of power drills in 1995 to discourage the placement of fixed anchors and potential proliferation of new climbing trails. In addition, several rock-climbing sites are monitored and climbing access periodically limited since 2003 to determine if peregrines use these areas. A program that combines climber education, outreach, partnering with climber organizations, and an assessment of climbing impacts on natural resources would help limit negative effects of rock-climbing to natural resources at NERI (Jarvis 2002). In addition, maps of popular climbing routes overlaid with maps of sensitive habitats and species would enable resource managers to identify sites with potential conflicts between resource conservation and recreational use.

Camping

Primitive camping by visitors is permitted at NERI. Little is known about these campsites and their effects on natural resources in the park. These camping sites (including overnight camping sites used by rafters) should be identified, mapped, evaluated, and improved if significant adverse impacts to natural resources are found.

Hunting

No research has been conducted on the number of hunters or the effects of hunters on natural resources at NERI. There is, however, the potential for littering, camping and its associated impacts, and tree damage (from tree stand construction). Currently, populations of game animals hunted in NERI do not seem to be adversely affected by hunting from a conservation perspective

and a reduction of white-tailed deer populations would benefit many native plant communities that are currently overgrazed by deer in the park (J. Perez, 2003, NPS, pers. comm.).

Conclusions

NERI supports a variety of natural resources that are intrinsically significant to the park. The globally significant natural resources found in NERI are large populations of Allegheny woodrats, an abundance and diversity of breeding neotropical migratory birds, including the cerulean warbler, an abundance and diversity of salamanders, the rare Appalachian flatrock community type, and the large expanse of unfragmented forest that contains a diversity of forest types (mixed-mesophytic, rimrock pines, oak-hickory, and hemlock). The nationally significant natural resources found in NERI are floral diversity, especially within the New River Gorge portion of the park, and the geology of the New River Gorge itself. Regionally significant natural resources of the park are a diverse assemblage of bats and the co-occurrence of two subspecies of painted turtles. Wetlands, healthy populations of game animals (white-tailed deer, black bear, and wild turkey) and game fish (smallmouth bass and catfish), and the presence of a variety of state species of special concern contribute to the local and state significance of the park.

A particular combination of moist climate, steep topography, hard quartz sandstone geology, and an ancient river system shaped the pre-European natural resource conditions at NERI. This historic condition consisted of large expanses of mature mixed-mesophytic forest dotted with smaller rimrock pine, oak, hemlock, and riparian forest components. Early successional habitat consisted of forest openings created by tree fall gaps and Appalachian flatrock communities shaped by repeated flood events. The quartz sandstone geology of the gorge walls made landslides a periodic occurrence.

European settlement and industrialization completely transformed this landscape in the early- to mid-20th century so that today, oak-hickory forests dominate at NERI and Appalachian flatrock and other riparian plant communities are declining due to the impoundment of the New River by Bluestone Dam. However, forest succession is transforming the forest back to the mixed-mesophytic forest type and many of the park's inherently significant resources, including diverse avian, salamander, and floral communities, continue to thrive.

Today, within the large matrix of continuous forests, a wide variety of habitat elements (both natural and cultural) support assemblages of plants and animals in the park. For example, abandoned mine portals, a cultural landscape element, provide habitat for rare species of bats, Allegheny woodrats, and cave salamanders. Sheer cliff faces support sensitive plant species, rare green salamanders, and, perhaps, significant invertebrate assemblages. Forest seeps and the Kates Branch Wetland contain populations of wetland birds, provide breeding ground for amphibians, supply habitat for invertebrate assemblages, and contribute to vegetation diversity in the landscape.

In much of the park the natural succession of oak-hickory forest to mixed-mesophytic forest should be permitted to continue, as the presence of large, unfragmented blocks of forest and the diverse forest components (mixed mesophytic, rimrock pine, oak-hickory, and hemlock) are globally significant resources at NERI. However, forest components, such as oak-hickory forest stands and rimrock pine communities, also should be maintained by the reintroduction of

prescribed fire in appropriate locations throughout the park. Hemlock forests should be monitored and protected from the invasive hemlock woolly adelgid and small, early successional patches of habitat should be maintained around abandoned mine portals to allow species of birds that rely on early successional habitat to persist in the park. The park's population of white-tailed deer should continue to be controlled through regulated hunting to ensure forest regeneration and to protect the nationally significant floral diversity found in the park. A plan to control invasive nonnative plant species also should be developed and implemented.

In order to restore disturbance-mediated riparian plant communities perhaps periodic floods, reminiscent of the pre-impoundment period, can again occur at NERI with the cooperation of the U.S. Army Corps of Engineers. However, if these flood events are conducted they should be carried out with extreme caution due to their potentially hazardous effects on human life and property. In addition, the land-use history of logging and mining may alter the impacts of flood events from those experienced prior to European settlement. In addition, many of the aquatic resources of the park, fish, salamanders, mussels, and even riparian forests, are seasonally sensitive to flooding. For example, flood events that occur in late spring or early summer can destroy fish spawning habitat and alter macroinvertebrate production.

Poor water quality found in the New River and its tributaries should recover if sewage and stormwater treatment can be improved outside the park. Resource managers at NERI should cooperate with local communities to remove and replace failing septic systems and water treatment plants. With better water quality aquatic macroinvertebrate and native fish diversity may increase and recreational experiences will improve. Without these water-quality improvements, health warnings due to unsafe levels of pollutants likely will continue to be posted along the tributaries at NERI.

Today, stream pollution, sedimentation, nonnative species introduction, logging and mining within park boundaries, some limited recreational disturbances, and increased development outside the park are the major human influences at NERI. With proper planning, however, human impacts to natural resources can be limited, and cultural and recreational use of the park can be entirely compatible with good natural resource conservation. For example, proper design and placement of trails, recreational day-use sites, and park structures will ensure that the intrinsically significant natural resources of NERI are protected. In addition, development in the park should be planned to minimize fragmentation of all large forest blocks. Planning should also be directed towards reducing the ecological impacts of existing and new fragmenting features such as roads, trails, and park facilities.

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Appendix A. Suggested desired future conditions and management prescriptions for intrinsically significant aquatic habitat , wildlife habitat, and plant communities at New River Gorge National River.

Suggested desired future conditions and management prescriptions were formulated for intrinsically significant aquatic habitat, wildlife habitat and plant communities at New River Gorge National River during a workshop held in May 2003. This workshop was attended by research scientists, technicians, and resource managers who are familiar with the intrinsically significant resources at the park. Desired future conditions were formulated around three main areas: aquatic habitat resources, wildlife habitat resources, and plant communities. These conditions and prescriptions (recommendations) are strictly the collective opinions of the workshop attendees.

Aquatic Habitat Resources

The two significant aquatic habitat resources were: River Ecosystems and Special Aquatic Habitats.

1. River ecosystems desired future condition: A healthy and diverse river ecosystem focusing on tributary health/functions and the connections with the riparian community.
   Management prescriptions:
   a. Map tributary watershed and sub-drainages and create a digital elevation model which also could be used to map/model/predict wetland seeps;
   b. Using existing research data, identify 30-40 key tributaries, their key functions, and characteristics, and where appropriate, negative impacts that managers should be aware of and address;
   c. Determine internal and/or external jurisdiction over tributaries and identify potential partnerships toward minimizing land-use impacts on water quality;
   d. Map riparian communities and identify conservation measures to limit fragmentation and interference with natural successional processes; and
   e. Working with partners, develop best management practices for land use and activities affecting tributaries.

2. Special aquatic habitats desired future condition: Protect special aquatic habitats since they frequently include rare species. Such habitats may include: vernal pools, ephemeral streams, roadside ditches and pools, seeps, mine portals, etc.
   Management prescriptions:
   a. Model and/or map likely locations of special habitats, creating a dynamic map responsive to the transient nature of some of these habitats and the developing scientific data;
   b. Describe and identify special aquatic habitats and develop best management practices capable of providing preliminary protection. These best management practices would be a “first defense” for habitats until their specific locations and characteristics could be identified and an individually appropriate protection plan can be provided; and

c. Manage trails and other access to minimize impacts to special habitats, and integrate information on special aquatic habitats into trails and maintenance plans.

Wildlife Habitat Resources

The four significant wildlife habitat resources were: cliff communities, abandoned mine portals, diverse upland forests, and riparian plant communities.

1. Cliff communities desired future condition: Cliff habitats which sustain populations of rare and significant species such as lizards, timber rattlesnakes, cave salamanders, Allegheny woodrats, peregrine falcons, ravens, small-footed myotis, Townsend's big-eared bat, and terrestrial invertebrates (snails).

   Management prescriptions:

   a. Determine where cliff-dependent species are and delineate the cliff habitat and its zone of influence;
   b. Establish high-use recreational areas that would minimize the impact to cliff-dependent species;
   c. Identify and protect key cliff natural resource areas and limit access seasonally;
   d. Monitor and assess the impact of visitor use on cliff resources at overlooks (vistas), on hiking trails, and on climbing routes;
   e. Determine and maintain important cliff features such as shade, water drainage, and rock fractures; and
   f. Limit development of overlooks and cliff line trails to areas that least affect cliff-dependent resources.

2. Abandoned mine portals habitat desired future condition: Key abandoned mine portals (that house rare species) maintained to provide for public safety, that support sustainable populations of rare and significant species such as Allegheny woodrats, cave salamanders, Indiana bats, two species of big-eared bat, and other bat species.

   Management prescriptions:

   a. Synthesize existing GIS overlays to identify "key" portals;
   b. Assess the physical characteristics of key portals. In other words, identify why species are using these portals and determine the internal conditions such as temperature range, air flow, size, and safety. Some data exists for this assessment;
   c. Determine the need to secure and limit access to particular portals. Access can be limited via trail relocations, gating/fencing, and signs/warnings;
   d. Continue to monitor portals for use by rare and significant species. Maintain hydraulics in portals for salamanders;
   e. Use the most cost-effective approach to maintain portals as habitat for significant biotic resources, keeping in mind that the portals are a human-made resource and will degrade over time; and
   f. Develop cultural and environmental education programs for the public and stress safety and seasonal considerations for visiting mine portals.

3. Diverse upland forest habitat desired future condition: Forests with natural gap dynamics and disturbance regimes in place to ensure a heterogeneous, diverse forest community that will support significant populations of cerulean warblers, other neotropical migrants, Allegheny woodrats, bats, woodland salamanders, snakes, and gap species such as golden-winged warblers.

    Management prescriptions:

    a. Manage exotics to limit invasion to edge habitats;
    b. Examine and analyze existing bird point count data to determine habitat use/location/requirements for cerulean warblers and other neotropical migrants and set management prescriptions stemming from this knowledge;
    c. Periodically monitor to see if cerulean warbler and other neotropical migrant populations are being maintained;
    d. Reclaim and regenerate clearcuts and mine lands to forest. If these areas are small (<2.02 ha [<5 ac]), may instead want to maintain as a gap for shrubland and early successional species;
    e. As lands are acquired by the NPS, assess clearcut lands and determine best regeneration option (e.g., hands-off, planting);
    f. Consider implementing a prescribed fire policy in xeric oak-hickory and in pine communities; and
    g. Continue and, perhaps, expand deer hunting in order to maintain forest regeneration.

4. Riparian plant community habitat desired future condition: Various riparian communities that support riparian birds (Louisiana waterthrush, kingfisher, herons, and sandpipers), streamside salamanders (e.g., black-bellied salamander), stream salamanders (e.g., hellbender), dragonflies, water shrews, river cooters, and green frogs.

    Management prescriptions:

    a. Remove exotic plants from riparian areas, especially Japanese knotweed, stiltgrass, and purple loosestrife;
    b. Assess the impacts of sewage and non-point source pollution to water quality;
    c. Conduct a comprehensive inventory of riparian communities, determine habitat needs of riparian species, and develop management plans;
    d. Survey raft put ins, pulloffs, and launch areas to determine impacts of visitor-use patterns on natural resources;
    e. Re-create natural flow regimes (need to determine what these are); and
    f. Identify threatened and endangered critical habitats and limit visitor access. Institute environmental education as means to do this.

Plant Communities

The five significant plant communities were: contiguous forest, riparian corridors, Appalachian flatrock, cliffs, and invasive, nonnative plants.

1. Contiguous forest desired future condition: NERI is 80-90% contiguous forest and natural processes of tree fall gaps, fire, and climatologically induced dynamic change should be permitted to occur in these forests. Within areas designated under this

condition minimize fragmenting features and remove fragmenting features if not needed for cultural interpretation and/or park management.

Management prescriptions:

a. Identify current blocks of contiguous forests;
b. Identify current breaks (roads, rights-of-way);
c. Identify areas to combine blocks and/or develop corridors for species movement;
d. Identify zones of management for allowable development; and
e. Allow natural ignition fires to burn under prescribed conditions. These types of fires will help maintain natural forest gap dynamics and increase plant species diversity.

2. Riparian corridor desired future condition: A to-be-determined percentage of riparian corridor is in a natural state by minimizing utilization and development.

   Management prescriptions:

   a. Allow for natural flooding regime to renew scour communities by setting succession back;
   b. Determine maximum allowable flooding regime and work with U.S. Army Corps of Engineers to have a periodic maximum flood;
   c. Inventory riparian zone, determine areas of natural undeveloped edge, and have no additional development within these areas;
   d. Restore additional riparian zones as land becomes available that is not critical to cultural interpretation or recreation; and
   e. Study the impacts of alternate flooding regimes (modeling approach may be appropriate).

3. Flatrock desired future condition: Current Appalachian flatrock communities in the gorge are maintained.

   Management prescriptions:

   a. Remove exotic species within designated boundaries of NERI's two flatrock communities;
   b. Minimize recreational use and ban camping and fires.
   c. Put up signs explaining exceptional qualities of these areas to dissuade unauthorized use; and
   d. Study the growth and reproduction characteristics of existing rare plants in these communities.

4. Cliff communities desired future condition: Current cliff communities at NERI are maintained.

   Management prescriptions:

   a. Research existing ecological communities of cliffs and try to understand how this resource interacts with recreational use;
   b. Develop certain cliff areas for intensive recreational use. Monitor use at other areas and put up signs explaining fragile ecology of these sites; and
   c. Study the ecology of plants (e.g., lichens) on cliff faces. An inventory of the plants found on cliff faces should be highest inventory priority.

5. Invasive, nonnative plants desired future condition: Invasive species and their impacts to NERI's natural communities are minimized.

   Management prescriptions:

   a. Create a list of most problematic invasives that could move into natural areas;
   b. Select best examples of small patch communities (that harbor rare species) and create and implement management plan to eliminate or minimize introduction of invasive, nonnative species;
   c. Identify and remove source populations of nonnative species;
   d. Determine impact of horses and llamas (along trails) with respect to spread of exotics; and
   e. Determine and implement proper restoration methods following removal of exotics.

Appendix B. Suggested desired future conditions and management prescriptions for intrinsically significant forest and other plant communities and associated ecological processes at New River Gorge National River.

Suggested desired future conditions and management prescriptions were formulated for intrinsically significant forest issues, resources, and processes at NERI during a workshop held in May 2003. This workshop was attended by research scientists, technicians, and resource managers who are familiar with the intrinsically significant resources at the park. Desired future conditions were formulated around two areas: nonnative and invasive species and forest health, and forest and other plant community diversity. These conditions and prescriptions (recommendations) are strictly the collective opinions of the workshop attendees.

Nonnative and invasive species and forest health

The two significant nonnative/invasive species and forest health issues were nonnative species impacts to forests and establishing a forest health inventory and monitoring system.

1. Nonnative and invasive species impacts to forests desired future condition: Effects of exotic species (e.g., Japanese knotweed and paulownia), invasive natives (e.g., white-tailed deer and red maple), and nonnative pests (e.g., hemlock woolly adelgid [HWA], gypsy moth, and tree diseases) on the structure, composition, and ecological processes within forest communities at NERI are limited.

   Management prescriptions:

   a. Create HWA and gypsy moth management plans;
   b. Conduct monitoring to determine extent of exotic pest infestation and location of infestation;
   c. Review and determine management options (chemical, mechanical, and biological) and treatment thresholds;
   d. Determine where to implement management options based on health and safety, threatened and endangered species or communities, and other natural resource threats;
   e. Implement management options and invest in human resources for implementation;
   f. Monitor the implementation and adjust as necessary; and
   g. Review NPS Natural Resource Management Guideline policy 77 and IPM policy.

2. Forest health inventory and monitoring system desired future condition: A forest health inventory and monitoring program is established to detect forest pests and forest composition and structure trends within specific forest types or on specific physiographic sites.

   Management prescriptions:

   a. Determine where old growth is located;
   b. Better understand the relationship between soils (including acidic soils), ozone, and forest health; and

c. Set specific objectives that state explicitly what trends to detect and base the inventory and monitoring program on ecological land units (physiographic conditions). Refer to Shenandoah National Park's newly renovated inventory and monitoring program.

Forest Community Diversity

The eight significant forest and other plant community diversity issues were general forest diversity, rimrock pine communities, flatrock/riverscour communities, riparian/floodplain forests, xeric oak forests, mixed-mesophytic, eastern hemlock forests, and Kates Branch Wetland.

1. General forest diversity desired future condition: All preindustrial forest community types are sustained at NERI (where possible) and forest community diversity is maintained at NERI. Be especially vigilant about the following communities:
   - eastern hemlock (Fern Creek and Grandview)
   - flatrock
   - oak-hickory
   - xeric oak (a.k.a. sites best adapted for oak in the absence of chestnut)
   - pine communities
   - riparian/floodplain forest
   - mixed-mesophytic forest
   - old-growth forests

   Management prescriptions:
   a. Determine and maintain natural processes that produce the variability of forest types listed above (including natural fire regime) and
   b. Identify where old-growth forests exist.

2. Rimrock pine communities desired future condition: Rimrock pine communities are maintained at NERI.

   Management prescriptions:
   a. Gain more knowledge about the rimrock pines by mapping, inventorying, and monitoring these stands;
   b. Research fire and disturbance history in these stands using dendrochronology and other appropriate means. Need to determine if this community type is fire dependent;
   c. Study the overstory/understory dynamics and how succession is shaping stands;
   d. Determine preindustrial range of rimrock pine stands via old photos;
   e. Identify where best to implement management;
   f. Conduct experimental burns to determine methods for regeneration;
   g. Investigate state of natural regeneration;
   h. Consider other methods for aiding regeneration such as use of herbicides and mechanical treatments to remove competing species and plantings; and
   i. Assess impacts of human access, especially trampling resulting from visitors approaching from the upland roads, or from rock climbing.

3. Flatrock/riverscour community desired future condition: Appalachian flatrock communities at NERI are maintained.

    Management prescriptions:

    a. Evaluate results of current burn research on flatrock communities;
    b. Estimate flood conditions necessary to create primary succession conditions (e.g., timing, flood levels);
    c. Inventory rare plant species and exotics/invasives to determine their respective roles in succession;
    d. Develop weed control management program; and
    e. Establish long-term monitoring plots (including herbaceous plants).

4. Riparian/floodplain forests desired future condition: A flood regime is established that develops and supports continuity and physical integrity, both horizontally and vertically, of floodplain forests.

    Management prescriptions:

    a. Inventory exotic invasive species in the floodplain forests;
    b. Consider strategies to control exotics where they are a problem (mechanical, chemical, and fire);
    c. Work with U.S. Army Corps of Engineers to ensure flood regime supportive of plan;
    d. Move development off river (utilizing information from ethnographic studies);
    e. Develop understanding of visitor access issues;
    f. Reduce free-range camping by closing road; and
    g. Determine appropriate recreational uses, levels of use, and access.

5. Xeric oak-hickory forest desired future condition: Xeric oak-hickory forests are maintained at NERI.

    Management prescriptions:

    a. Use prescribed burning on specific sites, e.g., in gaps to promote regeneration;
    b. Locate areas where red maple and other competing species predominate understory (these areas are the oak decline areas); and
    c. Remove large hazard trees and collect cross-sections for fire history analysis. In addition, collect disks from trees cut in adjacent logging operations on private lands.

6. Mixed-mesophytic forest desired future condition: Mixed-mesophytic forest type at NERI is maintained and allowed to expand.

    Management prescriptions:

    a. Establish vegetation map, identify subcommunities within the mixed-mesophytic community type, and prioritize areas for conservation;
    b. Eliminate fragmenting features such as railroads, roads, and parkways, but identify where roads are damaging the forest and are costly to maintain and relocate;
    c. Avoid development in unfragmented and roadless areas; and
    d. Reconnect forest blocks to restore functionality to community.

7. Eastern hemlock forest desired future condition: Hemlock community type at NERI is maintained.
   Management prescription:
   a. Monitor and control HWA.

8. Kates Branch Wetland desired future condition: Natural processes in Kates Branch Wetland are maintained. This wetland is approximately 24.28 ha (60 ac) in size and is regionally locally significant due to the variety of plants and wildlife found in the wetland. This wetland is maintained via beaver ecology. No specific management prescriptions were suggested.

Appendix C. Suggested desired future conditions and management prescriptions for intrinsically significant geologic and hydrologic conditions and processes at New River Gorge National River

Suggested desired future conditions and management prescriptions were formulated for intrinsically significant geologic and hydrologic resources at NERI during a workshop held in May 2003. This workshop was attended by research scientists, technicians, and resource managers who are familiar with the intrinsically significant resources at the park. Desired future conditions and management prescriptions (recommendations) were formulated around two areas: geology (including sedimentation) and hydrology. These conditions and prescriptions are strictly the collective opinion of the workshop attendees.

Geology (including soil and sedimentation)

The six significant geologic conditions and processes were mass flux and biotic resource occurrences, mass balance of sedimentation, drainage, landslide/flood damage, sediment contamination, and establishing educational geology tours.

1. Mass flux and biotic resource occurrences desired future condition: System-wide equilibrium balance among mass fluxes (waterflow and sedimentation) and biotic occurrences are determined and established.
   Management prescription:
   a. Categorize current flow frequencies and map geomorphic surfaces (bottomland and hillslope) with vegetation, bedrock (available from Englund 1977 - WV Geologic Survey), and aquatic biology overlays.

2. Sedimentation desired future condition: NERI has mass balance in regard to sediments, water, and dissolved solids. In other words, what comes in should go out.
   Management prescriptions (the following management prescriptions would take one to two years full-time to be completed by a geologist):
   a. Use LIDAR program to map geomorphology and hydrology and couple the mapping with ground truthing;
   b. Determine location and volume of mine tailings in NERI;
   c. Monitor indicator species for occurrence (e.g., are non-floodplain plant species invading floodplain?);
   d. Examine soil profiles to look for burying of A horizons or truncated A horizons. These soil profiles can provide indications of how sedimentation processes are occurring or changing; and
   e. Examine soil chemistry and water sediment chemistry.

3. Drainage desired future condition: Normal drainage processes are properly established where appropriate in NERI, keeping in mind conservation of upland habitat.
   Management prescriptions:
   a. Map railroad grades, stripmine benches, and other areas (haul roads) where drainage has been disrupted;

b. Where possible, remove and/or reclaim benches and roads. Determine how these removals and reclamations would affect accessibility and natural resources (CSX funding may be available); and
c. Review park and external construction projects and determine potential effects on drainage.

4. Landslide/flood damage desired future condition: A GIS-based landslide and flood damage inventory and monitoring program is established. The purpose of this program is to determine hazard zones and avoid development and use of the zones. This program can also be used for reclamation and reengineering if necessary.
   Management prescriptions:
   a. Create database with existing landslide data sets;
   b. Conduct yearly analysis in March of satellite and photographic imagery to determine if new landslides and/or flood damage has occurred;
   c. Review historic photographs (1930s, 1950s, and 1970s) to establish past landslide locations and to determine where mine spoils are located; and
   d. Mitigate hazards where appropriate.

5. Sediment contamination desired future condition: Contamination load (arsenic, selenium, pesticides, and petro-chemicals, etc.) of sediments is known so that mitigation can occur, if possible.
   Management prescriptions:
   a. Conduct water and sediment sampling upstream and downstream in NERI. Some data is available from USGS for Piney Creek, Hinton, and Thurmond;
   b. Conduct ecological risk assessment to plants and animals using results from sampling; and
   c. If dangerous levels of contaminants are found, conduct systematic sampling to find source area, and mitigate as appropriate.

6. Educational geology tour desired future condition: A "Geology Tour" for NERI is developed and conducted.
   Management prescriptions:
   a. Interpret natural, historic, and cultural values;
   b. Incorporate the tour at the Sandstone Visitor Center; and
   c. Develop tie-ins with National Coal Heritage Area.

Hydrology

The four significant hydrology conditions and processes were water quality of the New River and its tributaries, stream channel morphology, riparian zone ecology, and developing watershed partnerships.

1. Water quality of the New River and its tributaries desired future condition: The main stem and tributaries of the New River will have water quality high enough for public contact (suitable for boating, swimming, and fishing).

Management prescriptions:

a. Establish current water quality conditions and identify data needs;
b. Eliminate direct discharge of primary sewage into tributaries and increase effectiveness of existing secondary treatment systems;
c. Identify and mitigate failing waste pumping systems within park;
d. Build upon existing park and USGS network to establish perennial stream gauging and stream water monitoring network; and
e. Attain a better understanding of hydrology of tributary streams including flood characteristics and extents, low flow characteristics, time and travel, river mileage, and channel morphology.

2. Stream channel morphology desired future condition: Stability of stream channel morphology is maintained/improved to protect the tributaries and main stem natural processes as they relate to erosion, deposition, water quality, and healthy function of aquatic habitat.

   Management prescriptions:

   a. Maintain and modify existing system to include measurements of sediment and major water quality characteristics;
   b. Combine inventory and mapping of seeps, springs, mine discharge, and other groundwater sources to understand the hydrologic environment relating to habitat, slope stability, base flow contributions, and overall groundwater conditions; and
   c. Identify wetland resources and develop understanding of hydrologic regimes.

3. Riparian zone ecology desired future condition: The healthy functioning of riparian zones in the tributaries and main stem is understood and maintained.

   Management prescriptions:

   a. Complete vegetation survey; and
   b. Develop floodplain maps for lower reaches of tributaries and main stem.

4. Watershed partnerships desired future condition: A systematic partnership program with NPS and other watershed stakeholders is established in order to protect and improve watershed integrity.

   Management prescriptions:

   a. Reforest disturbed lands;
   b. Analyze adjacent land use patterns within the watershed and correlate them to identified impacts on park resources related to water quality;
   c. Prioritize partnership opportunities and resource expenditures; and
   d. Identify potential transportation and infrastructure (pipelines) that may contribute to accidental discharges in park watershed/tributaries and establish response procedures for ecosystem and human safety.

Appendix D. Names, areas of expertise, and affiliations for professionals with knowledge of the natural resources of New River Gorge National River.

Name	Area of expertise	Affiliation
Hugh Bevans	Geologist and Division Chief	U.S.G.S., Water Resources Division, Charleston, WV
Steven Castleberry	Vertebrate ecologist	School of Forest Resources, University of Georgia, Athens, GA
Doug Chambers	Biologist/Water Quality Specialist	U.S.G.S., Water Resources Division, Charleston, WV
Daniel Evans	Botanist	Department of Biology, Marshall University, Huntington, WV
Mark Ford	Forest ecologist	U.S. Forest Service, Northeastern Research Station, Parsons, WV
William Grafton	General field ecologist	Agriculture and Natural Resources Extension, West Virginia University, Morgantown, WV
Jeff Hajenja	Vertebrate ecologist	WV Department of Natural Resources, Charleston, WV
Ray Hicks	Forest ecologist	Department of Forestry, West Virginia University, Morgantown, WV
Cliff Hupp	Geologist	U.S.G.S. National Research Program, Reston, VA
James Johnson	Forest ecologist	Department of Biology, Virginia Tech, Blacksburg, VA
Tom Jones	Invertebrate ecologist	Department of Biology, Marshall University, Huntington, WV
Steven Kite	Geologist	Department of Geology and Geography, West Virginia University, Morgantown, WV
Brian McDonald	Botanist	WV Natural Heritage Program, Elkins, WV
Samuel Norris	Botanist	WV Natural Heritage Program, Elkins, WV
Brad Onken	Forest ecologist	U.S. Forest Service, Northeast Area Forest Health Protection Office, Morgantown, WV
Waite Osterkamp	Geologist	U.S.G.S., Desert Laboratory, National Research Program, Tucson, AZ
Thomas Pauley	Vertebrate ecologist	Department of Biology, Marshall University, Huntington, WV
Doug Raeburn	Fire ecologist	Retired, Shenandoah National Park, Luray, VA
Jonathan Remo	Geologist	Geoscience Group, Shaw Consulting, Knoxville, TN
Tom Schuler	Fire ecologist	U.S. Forest Service, Northeastern Research Station, Parsons, WV
Dale Suiter	Botanist, Fish and Wildlife ecologist	U.S. Fish and Wildlife Service, Raleigh Field Office, Raleigh, NC
Ralph Taylor	Invertebrate ecologist	Department of Biology, Marshall University, Huntington, WV
James Vanderhorst	Community ecologist	WV Natural Heritage Program, Elkins, WV
Doug Wallner	Forest ecologist	National Park Service, Philadelphia Support Office, Philadelphia, PA
Mark Watson	Vertebrate ecologist	Department of Biology, Marshall University, Huntington, WV
Stuart Welsh	Fish biologist	Department of Forestry, West Virginia University, Morgantown, WV
Petra Wood	Vertebrate ecologist	WV Cooperative Fish and Wildlife Research Unit, Morgantown, WV

Appendix E. Geographic Information System (GIS) data sets available for New River Gorge National River.

Data Set	Publication Date	Scale	Source	Description and Comments
Park Boundaries	December 2002	unknown	Resource Management, NERI	
Land Ownership	December 2002	unknown	Resource Management, NERI	
Park Trails	2002	unknown	Recreational grade Global Positioning System (GPS) data, digital ortho quadrangle (DOQQ), Map Grade GPS	(may not meet National Map Accuracy Standards)
Visitor Use Facilities	January 2003	unknown	Resource Management, NERI	General reference locations for park facilities. Not spatially accurate
Geology (General)	August 2000	1:250,000	West Virginia Geological and Economic Survey	Based on the 1968 Statewide Geologic Map
Mountaintop Mining Removal-State	1998	1:100,000	West Virginia Geological and Economic Survey	Based on the 1998 report “A Geologic Overview of Mountaintop Removal Mining in West Virginia.” Approximate region of present and projected major mountaintop removal mining activity.
Coalfields of WV	1960	1:5,000,000	U.S. Geological Survey	Most of the material for the conterminous United States was collected from James Trumbull's "Coal Fields of the United States, Conterminous United States" map (sheet 1, 1960). Polygon attributes include area, rank, description, province, and name (region).
1996 Color Infrared (CIR) Digital Orthophotos	1996-1999	1:12,000	U.S. Geological Survey	1 meter pixel resolution CIR imagery
Digital Raster Graphics		1:24,000	U.S. Geological Survey	Seemless
Digital Line Graph data including roads, hydrology, hypsography (contours), etc. 1:24,000 scale		1:24,000	U.S. Geological Survey	Seemless by park. Processed by North Carolina State University and edge matched.

Appendix E. Geographic Information System (GIS) data sets available for New River Gorge National River (continued).

Data Set	Publication Date	Scale	Source	Description and Comments
Digital Elevation Models (DEM)		1:24,000	Originator is the U.S. Geological Survey. These Level 2 DEMs were generated from (1) 1:24,000-scale hypsography digital line graph (DLG) data or from (2) vector data derived from scanned raster files of USGS 1:24,000-scale separates.	The 7.5-minute digital elevation model (DEM) data are digital representations of cartographic information in a raster form. The DEMs consists of an array of elevations for ground positions at regularly spaced 10-meter intervals. DEMs can be used as source data for digital orthophotos, and for earth science analysis as layers in geographic information systems. DEMs can also serve as tools for volumetric analysis, for site location of towers, or for drainage basin delineation.
WV Geodetic control points		1:24,000	National Geodetic Survey	Bench marks and survey points maintained by the National Geodetic Survey (NGS). Geodetic data comprise the results of geodetic surveys to determine, among other things, latitude, longitude, height, scale, and orientation control.
Floodplain data	October 2002	1:24,000	Federal Emergency Management Agency (FEMA)	FEMA produces flood insurance rate maps (FIRMs) for the purposes of determining whether properties lie within the floodway of a river system or the 100-year floodplain.
10 digit hydrologic unit watersheds	January 2002	1;100,000	Natural Resources Conservation Service	"Watershed" hydrologic units, a subdivision within a sub-basin, represent the 5th level (10-digits) in the hydrologic unit hierarchy. Watersheds range in size from 40,000 to 250,000 acres
New River scanned mine inventory maps			Resource Management, NERI WV Gap Analysis Program, West Virginia University, Armstrong and Yuill, 1991	These were used to partially digitize "Disturbed Lands." The rest will need to be georeferenced and digitized. File: Mine_Inv_Sites
Abandoned Mine Lands - points and lines downloaded from WV GIS Tec	1996	1:24,000	Office of Abandoned Mine Lands and Reclamation (AMLR) of the West Virginia Department of Environmental Protection	AML features were digitized from AMLR source materials by the WVU Department of Geology & Geography and the WVU Natural Resource Analysis Center. Published in 1996. The AMLR eliminates damage that occurred from mining operations prior to August 3, 1977 and is funded by the AML fund. It corrects hazardous conditions and reclaims abandoned and forfeited mine sites. Typical AML features include high walls, portals, refuse piles, and mining structures such as tipples.

Appendix E. Geographic Information System (GIS) data sets available for New River Gorge National River (continued).

Data Set	Publication Date	Scale	Source	Description and Comments
Soils (old soil surveys)	1975 &1984		Resource Management, NERI; original work performed by Richard Easterbrok, GIS Specialist, NPS	Some have been scanned and digitized but will have to be rubbersheeted to line up with our other data. About half of NERI done.
GNIS (Geographic Names Information System) -	unknown - present	1:24,000	U.S. Geological Survey (USGS) in cooperation with the U.S. Board on Geographic Names (BGN),	Contains points for towns, airports, hospitals, etc., both historic and current, from USGS topo maps. Not known for being up to date or spatially perfect. It is useful for placing historic towns, etc. that don't appear on modern day maps.
National Register Sites		1:24,000	State Historic Preservation Office	This GIS coverage was created from the National Park Service's National Register Information System (NRIS) database, a computerized inventory of the National Register of Historic Places. The National Register, established under the National Historic Preservation Act of 1966, is the nation's official list of cultural resources worthy of preservation. The National Park Service (NPS) administers the National Register, with the State Historic Preservation Office (SHPO) coordinating the National Register in West Virginia.
WV GAP Analysis data	April 2002	1:50,000	USGS -Biological Resources Division	Land Cover data set is a raster representation of vegetation/land cover for the state of West Virginia. This data can be used for landscape scale analysis in various disciplines such as wildlife ecology, forestry, or land use planning. The data have been developed for inclusion in the Gap Analysis Program. The source data were acquired from multiple 30-meter Landsat imagery obtained between 1992-1994 and field checked with videography.
Ecological Land Units- from Veg. Mapping contractor 2002 for NERI	May 2002	10 meter	John Bender, University of North Carolina	The data were intended to provide the NPS with a data set for use in planning to assess the biophysical diversity and to model the distribution of vegetation communities.

Appendix E. Geographic Information System (GIS) data sets available for New River Gorge National River (continued).

Data Set	Publication Date	Scale	Source	Description and Comments
Landforms - from Veg. Mapping Contractor	May 2002	10 meter	John Bender, University of North Carolina	The data were intended to provide the NPS with a data set for modeling topographic position or slope position.
National Land Cover Data	1992	1:50,000	U.S. Geological Survey (USGS) and the U.S. Environmental Protection Agency (US EPA)	Provides a consistent, land cover data layer for the conterminous U.S. using early 1990s Landsat thematic mapper (TM) data purchased by the Multi-resolution Land Characterization (MRLC) Consortium. This data can be used for landscape scale analysis in various disciplines such as wildlife ecology, forestry, or land use planning.
National Wetlands Inventory Data	February 1971 to Dec. 1992	1:24,000	US Fish and Wildlife Service	The data provide consultants, planners, and resource managers with information on wetland location and type
Sewage Treatment Plants - statewide	March 2002	1:24,000	WV DEP	Sewer and water treatment plants extracted from the WV Department of Environmental Protection's Water Resources Permitting Facilities database. Includes publicly owned treatment works (POTWs) and smaller treatment facilities.
General Highway Maps	2000		WV DOT	Scanned copies of the General Highway Maps. Not georeferenced at this time.
Lands Tract Files	Various	unknown	NERI Lands Office	Cadd dwg files for each tract map
Coalbeds	March 2003			West Virginia Geological and Economic Survey. This coverage defines the geographic area underlain by the coal bed.
Powerlines	September 2001	1:100,000	Resource Management, NERI	Powerlines clipped to park areas. Originally produced for the Fire program to show Air Hazards.
Tax maps	Various	unknown	Fayette and Raleigh County offices	Cadd dwg files for Fayette and Raleigh Counties tax parcel maps.
Cemeteries	2002	unknown	Resource Management, NERI	Cemeteries within or around NERI. Based on general location from 1:24,000 USGS topo maps.
Upland Vertebrates	1993	~ 1:24,000		Upland vertebrate locations from the "Report of the Upland Vertebrates in the New River Gorge National River, (1989-1990)" report. Points were originally plotted on 1:24,000 topographic maps then transferred as coordinates into a digital data set. No locational accuracy assessment has been done.

Appendix E. Geographic Information System (GIS) data sets available for New River Gorge National River (continued).

Data Set	Publication Date	Scale	Source	Description and Comments
Non-vascular flora	1997	~ 1:24,000	Resource Management, NERI	Points from the "Biological Surveys in Proposed Development Sites in the New River Gorge National River, Feb. 1997" report. No attributes other than site number at this time.
Vertebrates	1997	~ 1:24,000	Pauley et al. 1997; Marshall University	Points from the "Biological Surveys in Proposed Development Sites in the New River Gorge National River, Feb. 1997" report. No attributes other than site number at this time.
Invertebrates	1997	~ 1:24,000	Pauley et al. 1997; Marshall University	Points from the "Biological Surveys in Proposed Development Sites in the New River Gorge National River, Feb. 1997" report. No attributes other than site number at this time.

Appendix F. Synthesis Instructions

1. Place "Synthesis Program Installation Disc" CD in CD drive and follow instructions on screen.
2. Remove "Synthesis Program Installation Disc" CD.
3. Place "Synthesis Data Disc" CD in CD drive.
4. Go to your Program Files and click on Synthesis.
5. Under "Select Site" click on NERI.
6. Document outline will appear. Click on subject material, e.g., Fish, and choose report to read. All reports are full-text searchable and most will open in Adobe Acrobat.
7. Some links (e.g., Water Resources) will direct your computer to a Web site. For example, when you click on Water Quality and then NPS-NatureNet Water Resources, you will be directed to a Web page. Click on New River Gorge National River report found under Northeast Region. This will access the Water Resource Management Plan.
8. The Synthesis program will not run if it has no data to read, so make sure you have the Synthesis Data Disc CD in your CD drive.
9. For help and contact information: www.jmu.edu/synthesis/.

As the nation's primary conservation agency, the Department of the Interior has responsibility for most of our nationally owned public land and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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National Park Service
U.S. Department of the Interior

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